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CATHERINE R. McCABE
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May 28, 2019

Diane Salkie
U.S. Environmental Protection Agency (USEPA)
Region II Headquarters
290 Broadway, 19th Floor East
New York, NY 10007-1866

Re: Lower Passaic River Study Area (LPRSA)
17-Mile RI/FS Project (Upper 9 Miles)
Newark City, Essex
SRP PI# 332799
Activity Number Reference: RPC030001

Dear Ms. Salkie:

The New Jersey Department of Environmental Protection (NJDEP) has been involved with review and technical support to USEPA-Region 2 for the remedial investigation (RI) and risk assessments for the Lower Passaic River Study Area (LPRSA) 17-Mile Project. These documents were developed by the CPG with USEPA-Region 2 oversight, and with technical support by the Partner Agencies. This letter is provided to formalize the comments in NJDEP's email dated May 7th, 2019 to the USEPA (Jay Nickerson to Diane Salkie). The NJDEP generally agrees with the approval of the RI and most appendices. RI comments have been provided under separate cover (May 2, 2019), with the exception of Section 10, Appendices A and M. RI Appendix P-the Bioaccumulation Model, is still under development. However, the NJDEP is not in agreement with approval of the Baseline Ecological Risk Assessment due to evaluation methods utilized which, despite identifying the presence of unacceptable risk, *leaves ambiguous the degree of ecological risk observed, and does not provide clear direction for the protection of the more sensitive ecological receptors (including the 11 listed Endangered, Threatened* and species of Special Concern) and associated assessment and measurement endpoints for this river.

This concern has been described in prior NJDEP comments dated April 27, 2015, February 7, 2017, April 30, 2018, and more recently, March 13, 2019 (via email from A. Hayton, NJDEP-BEERA, to Diane Salkie, USEPA-RPM, and Michael Sivak, USEPA-Branch Chief). In addition, the NJDEP supports prior NOAA comments of April 6, 2018 and earlier review comments which had identified shortcomings in the methods used for the Sediment Quality Triad (SQT) and benthic invertebrate health evaluations. Recent review of these sections by the NJDEP have identified similar concerns.

As a result, the NJDEP does not endorse approval of the draft Baseline Ecological Risk Assessment for the Lower Passaic River Study Area (LPRSA) 17-Mile RI/FS (now referred to as

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the Upper 9 Mile Project). This is because the degree of ecological risk attributed to the chemical conditions of the sediment, water and biota of this river is not sufficiently presented, as should have been done at this stage of the project. The NJDEP identifies the goal of the BERA to quantify risk for, and ultimately protect, sensitive species. The primary deficiency identified is the current use of two sets of toxicity reference values (TRVs) to characterize risk for larger macroinvertebrates, fish, birds and mammals. Neither USEPA nor the NJDEP's written guidance specifically address the use of multiple sets of TRVs. It is the NJDEP's position that the single avian, mammalian, fish tissue and macroinvertebrate tissue TRV sets used for nine (9) contaminants in USEPA 2014[1] which evaluate the more sensitive species and endpoints, must be selected. This is especially important due to the presence of eleven threatened, endangered, and/or species of special concern associated with the river (BERA Table 2-7).

The use of two sets of TRVs generates wide-spanning risk ranges for many contaminant-receptor pairs. Uncertainty was further expressed via the calculation of additional hazard quotients using numerous alternate exposure assumptions (for example, Tables 8-15 through 8-17). As a result, reviewers and risk managers are left with incomplete and potentially confusing information for proceeding towards risk management decisions.

Additional Comments

1. The Risk Assessment and Risk Characterization (RARC) document, a primary planning-stage document to guide development of the risk assessments is not yet finalized and approved. The RARC is referenced numerous times throughout the BERA: ".... Revised RARC Plan (Windward and AECOM [in prep])". NJDEP comments dating back to the Feb. 2011 called for TRVs to be decided upon in the RARC. Many of the NJDEP's comments and concerns regarding the BERA would likely have been addressed earlier in this process, had these technical issues been satisfactorily addressed in the RARC, in advance of risk assessment development.

2. In both the Executive Summary and Section 13, Preliminary COCs, subsections identifying "Risk Drivers" are presented (e.g., ES.1.3 Ecological Risk Drivers, Section ES 6.3 and Table ES-4; similar subsection/table in Section 13). Associated BERA text indicates that the risk drivers will be further culled in the FS for determining which will be used to generate preliminary remedial goals (PRGs). This presumes a pre-selection process from preliminary COCs to risk drivers in this BERA, which has not been described or presented. Until the selection process for TRVs has been decided and performed, it's not possible to reduce preliminary COCs (Table ES-2) to a short list "...of risk drivers for further evaluation in the FS". Missing from the risk driver list are the following contaminants which have been identified as presenting unacceptable risk: Arsenic, Cadmium, Chromium, Copper, Lead, Methylmercury/mercury, Nickel, Selenium, Silver, Vanadium, Zinc, TBT, HPAHs, Dieldrin and Cyanide.

The identified risk driver contaminant categories (TCDD, PCBs, DDx), are shown to present high risk across numerous receptor groups. However, it's considered inappropriate to identify the risk drivers as those contaminants for further study in the FS *before* the TRV selection process has been completed because it prematurely eliminates contaminants shown to present unacceptable ecological risk (Table ES-2) without sufficient justification.

3. It is recommended that text is added to the BERA to state that the TRVs used in the 2014 FFS are primary for those situations where the same receptor and contaminant pairs exist in the upper 9 miles of the river as the lower 8 miles of the river. This preference is based on a need to protect the more sensitive receptors and toxicity endpoints due the presence of 11 listed Endangered, Threatened, and/or Species of Special Concern in the Lower Passaic River. CPG's TRVs are considered secondary.

4. Section ES.1.3 – Ecological Risk Drivers (page ES-24+): Text discusses a "number of preliminary COCs [that] were not recommended to be carried forward to inform major risk management decisions". The metals COCs associated with tissue HQs were eliminated from further consideration largely because "a LOEAL HQ $\geq$ 1.0 could not reliably predict risks to a level appropriate for costly remedial decisions". Elimination of the metals COCs does not appear to be protective and did not consider the magnitude of the calculated HQs. While some of the calculated HQs were only slightly greater than 1.0 (for example, arsenic, cadmium, mercury/methylmercury, silver, selenium, and dieldrin), others were significantly greater (for example chromium – 3.7 to 160, copper – see Bullet #1, lead – see Bullet #2, total HPAHs – see Bullet #3) and were greater than 1.0 for multiple LOEs. Some of those COCs with elevated HQs (for example, chromium, copper, and nickel) were not carried forward mainly because there was "uncertainty" in the assessments. It would seem appropriate to "carry forward" any COC that had an HQ $\geq$ 1.0 that has also been previously identified for remedial action in the lower 8 miles of the river (this would potentially include total PCBs, mercury, copper, dieldrin, LPAHS, HPAHs, and lead).

- Copper was not recommended as a risk driver despite having calculated HQs greater than 1.0 (and as high as 9.3 for fish tissue) for multiple LOEs;
- Lead was not recommended as a risk driver despite having calculated HQs ranging from 0.20 to 10 for spotted sandpiper, as well as HQs greater than 1.0 for other LOEs;
- total HPAHs were not recommended as a risk driver despite having calculated HQs ranging from 0.090 to 10 for two (2) LOEs.

5. The NJDEP re-iterates its support of prior technical review comments offered by NOAA throughout development of this BERA. These comments focused on ways to improve the evaluations of LPRSA benthic invertebrate health and were provided to USEPA and NJDEP via correspondence including, but not necessarily limited to, June 27, 2017, September 17, 2017, and April 6, 2018. Supplemental review comments have been developed by Joel Pecchioli, BEERA, on Section 6, for the SQT and benthic community health evaluation portions of the BERA. Based on recent discussions with USEPA, it is unlikely that further revision of these sections will occur before approval of the BERA. However, these comments are provided to USEPA for consideration during future evaluation of benthic invertebrate health, for risk management decisions, and for ongoing and future evaluation of surface water quality for the entire LPR. These comments are provided in Attachments C (Benthic Invertebrate Health) and D (Sediment Quality Triad (SQT) evaluation) below.

6. In response to the NJDEP's position regarding the subject BERA, a series of additional meetings and conference calls were held in March and April 2019. Please refer to Attachments

A through D to assess the NJDEP's position on the Oct 2018 BERA and respond to the March 29, 2019 USEPA email and attachments on this topic. In addition, comments on EPA's proposed LPRSA IR Process (ROD 1 FS to ROD 2) will be provided separately as part of the Interim Remedy FS working group meetings and collaboration effort. Through this collective effort, a clearer path towards development of risk-based remedial goals and appropriate remedial action for the Upper 9 Miles of the LPR is anticipated. The NJDEP's response to the USEPA – Region 2 March 29, 2019 email and attachments is provided as follows:

Attachment A, Action Item Responses;
Attachment B, Response to 3/29/2019 letter from D. Salkie, EPA, to J. Nickerson, DEP
Attachment C, Supplemental Comments on the BERA Benthic Invertebrate Health evaluation
Attachment D, Supplemental Comments on the BERA SQT evaluation

ATTACHMENT A

3/29/2019 EPA to NJDEP – LPRSA 17-Mile Action Item Responses
May 2019 DEP responses are provided sequentially to EPA Action Items

USEPA: As you are aware, EPA expects to approve the Baseline Ecological Risk Assessment (BERA) for the 17-mile LPRSA in the next few weeks. In that effort, we have agreed to request that the CPG add language to the document. This document will respond to some additional questions regarding how EPA plans to proceed with respect to the 17-mile LPRSA BERA.

NJDEP Response: In addition to the NJDEP disclaimer footnote, *it is recommended that text is added to the BERA to state that the TRVs used in the 2014 FFS are primary for those situations where the same receptor and contaminant pairs exist in the upper 9 miles of the river as the lower 8 miles of the river.* This preference is based on a need to protect the more sensitive receptors and toxicity endpoints due the presence of 11 listed Endangered, Threatened, and/or Species of Special Concern in the Lower Passaic River. CPG's TRVs are considered secondary.

USEPA: NJDEP asked that EPA explain in writing the process of how the BERA will lead to the development of risk-based remediation goals and the timeline associated with that. What are the criteria decision points?

See attached document entitled, "EPA Anticipated LPRSA Process for Both Interim and Final Actions"

NJDEP Response: Very helpful; NJDEP anticipates further discussion and development of this process with EPA and CPG.

USEPA: Provide description of how EPA will consider both TRVs when developing risk-based remedial goals.

- When developing remediation goals, EPA will look at both sets of TRVs and assess whether they both can be used to evaluate ecological effects to the Upper 9 miles. If so, EPA will evaluate the most applicable methodology (e.g., one study

value, or a statistically-derived value) and derive goals that are most appropriate for the biota at the site, based on the endpoints of survival, growth, or reproduction.

- In addition, the scientific literature will also be reviewed to identify whether any more recent studies should be considered for the finalization of TRVs.
- Once an ecological risk-based goal has been identified, it will be compared with a human health risk-based goal, and the more conservative value will represent the risk-based goal.
- The risk-based goal will be compared to appropriate background concentrations, and depending on site-specific factors, a decision will be made about which value should be selected.
- The selected value will be compared to the achievable analytical detection limit, and if the selected value is below achievable detection, the detection limit will be selected as the goal.

NJDEP Response: The NJDEP agrees with the general process described by sub-bullets 1-5. However, the NJDEP prefers to have had the TRV selection process performed to a sufficient degree in the current BERA, allowing identification of the estimated magnitude of ecological risk attributed to the current contaminated conditions of the river revealed by the RI data. This would also assist with identifying the list of contaminants warranting PRG consideration/development. Typically, identifying whether or not unacceptable risk exists is accompanied with an estimated magnitude of the risk bounded by a derived TRV NOAEL-LOAEL range. Given the resource-intensive effort already invested in vetting TRV information for this project (both through the Lower 8-Mile FFS and the 17-Mile RI), it's unclear what specific information is missing that prohibited TRV selection in the BERA, to advance this process for PRG development.

USEPA: EPA suggests adding text about NJDEP's disagreement with the use of two sets of TRVs as a footnote in the BERA Executive Summary and for supporting Executive Summary tables, as well as where the two sets of TRVs are first discussed in the BERA text and for supporting BERA tables.

NJDEP may put together language for EPA review that can be inserted in the LPRSA 17-Mile BERA document as a footnote or disclaimer where the two sets of TRVS are discussed or underly[sic] tabulated information.

NJDEP Response: Agreed. The NJDEP additionally requested inclusion of a BERA front-page disclaimer stating the NJDEP's position regarding the BERA, and possible text changes in the Executive Summary and Section 13 (summary/end of document). Subsequently, EPA agreed to include a footnote at locations in the BERA where TRVs are presented. Provided below is the agreed-upon disclaimer footnote (also provided in an email from DEP to EPA on April 24, 2019, along with recommended placement locations in the BERA).

NJDEP Disclaimer Footnote:

"The New Jersey Department of Environmental Protection (NJDEP) acknowledges that the Baseline Ecological Risk Assessment (BERA) for the Lower Passaic River Study Area (LSRPA) 17-mile RI/FS identifies unacceptable risk and a remedial action to address the unacceptable risk is necessary. However, it is NJDEP's position that a single toxicity reference value (TRV) set (No Observable Adverse Effect Level [NOAEL] and Lowest Observable Adverse Effect Level [LOAEL]) that evaluates the more sensitive species and endpoints to characterize risk to invertebrates, fish, birds and mammals should be selected in a BERA, not two sets of TRVs as was presented in this document. The NJDEP's *Ecological Evaluation Technical Guidance*, August 2018, does not advocate the use of more than one set of TRVs for individual contaminant-receptor pairs. It is the NJDEP's position that, for the LPRSA, use of one conservative TRV set derived for sensitive receptors and sensitive endpoints most clearly demonstrates the degree of risk for individual contaminant-receptor pairs and ensures protection of threatened, endangered and species of special concern."

USEPA: Add summary of risk table to Executive Summary based on DEP's submitted suggestion. After further discussions with our risk assessors and close review of the BERA, we do not believe this to be necessary since there already are numerous tables and text describing risk in the Executive Summary. See attached highlighted version of the executive summary that points to this text.

NJDEP Response: Review of the highlighted sections revealed that due to the dual TRV methodology presented/used throughout the BERA, the resulting wide-spanning risk for some key risk drivers and ecological receptors of concern is subject to broad interpretation by reviewers. In addition, current risk characterization in this BERA contrasts with the more conclusive risk characterization presented in the 2014 FFS Appendix D, Section 4, Tables 4- 15 to 4-19, where more definitive risk characterization to ecological receptors by site contaminants is presented.

USEPA: Follow up with HQ about NJDEP concerns with 2 TRVs

Region 2 personnel spoke to both Karl Gustavson (EPA HQ, CSTAG Chair) and Marc Greenberg (EPA HQ, ERT). Both agreed that EPA guidance does not limit ecological risk assessments to using only one set of TRVs to present the risk. There is no national recommendation for a single set of TRVs or for a single source of values to be considered as TRVs. The use of both NOAELs and LOAELs often results in risks being presented as a range, and the use of two or multiple TRVs is not inconsistent with EPA guidance. Conversations with both Mark and Karl included a discussion of the additional effort needed to review TRVs, including two or more sets of TRVs at a site, and while both acknowledged this results in an additional work load, both indicated that if multiple sets of TRVs were submitted, it would result in the risk estimates being presented as a range that would be evaluated by the risk assessor and the risk manager as part of the process, with the strengths and weakness of the different risks throughout the range evaluated during decision-making and during the development of ecological risk-based remedial goals.

NJDEP Response:

a. BEERA also reviewed EPA guidance and respectfully suggests that although the guidance does not specifically preclude use of two TRVs sets (i.e., silent on topic), this is not considered equivalent to endorsing this approach.
b. Regarding risk ranges, BEERA respectfully disagrees with the risk range comparison provided. In the current BERA, TRVs representing different toxicity endpoints (e.g., mortality vs. reproduction) for a single contaminant-receptor pair results in a confounding risk range because the toxicity endpoints are not the same. This contrasts with a single TRV NOAEL-LOAEL where the toxicity endpoint is the same, therefore the risk range is anchored by the same impact/risk.

Further, DEP's Ecological Evaluation Guidance Document (first issued in Feb 2012, latest update August 2018) has been largely modeled after ERAGs (and Eco Updates to same). It is BEERA's belief that the authors of ERAGs did not envision ecological risk assessments concluding with 2 or more TRVs for specific contaminant-receptor pairs, as this unnecessarily defers selection of the most appropriate thresholds/benchmarks for characterizing ecological risks to a point beyond the risk assessment, i.e., in the Feasibility Study. Highlight 1-4, page I-8 of ERAGs states: "*The ecological risk assessment should identify contamination levels* ***that bound a threshold for adverse effects on the assessment endpoint.*** *The threshold values provide a yardstick for evaluating the effectiveness of remedial options and can be used to set cleanup goals if appropriate.*" (emphasis added in bold). The bolded statement implies a singular assessment endpoint.

Section 7.3.1 of *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (USEPA 1997) states "The lower bound of the threshold would be based on consistent conservative assumptions and NOAEL toxicity values …[and the]… upper bound would be developed using consistent assumptions, site-specific data, LOAEL toxicity values, or an impact evaluation." When taken in context with the Eco Update *Ecological Significance and Ecological Significance and Selection of Candidate Selection of Candidate Assessment Endpoints* (USEPA 1996), which states when listed species are present, individual, not population or community, level effects are to be considered, this points to use of conservative TRVs, bounded by the NOAEL and LOAEL.

It remains the NJDEP's position that risk characterization protective of the more sensitive receptors and endpoints should be completed within the risk assessment step, prior to risk management, and in our view, ERAGs, other CERCLA guidance and NJDEP Guidance support this distinction.

USEPA: Review:

a. Removing the word "preliminary" from discussion of COCs in LPRSA 17-mile BERA

This point was raised by NJDEP in the March 13, 2019 email from Anne Hayton to Diane Salkie and is addressed in EPA's letter to Jay Nickerson dated March 29, 2019.

NJDEP Response: The context for the term is now understood, in that, it originated from a prior agreement between CPG and EPA and identifies all COCs which resulted in an HI $\geq$ 1 from any line of evidence as described in footnote 1 of the BERA Executive Summary. However, what remains unclear is whether risk drivers or preliminary COCs are to be carried forward to the next steps for further risk characterization and risk management. It is also noted that HI's $\geq$ 1 represents a range of *LOAELs from two different toxicity endpoints*, rather than a LOAEL-NOAEL risk range for a single evaluated TRV and toxicity endpoint. This approach precludes identifying COCs based on TRV NOAELs, arbitrarily places a ceiling on a contaminant's estimated potential toxicity and may reduce the number/type of COCs identified for further evaluation.

- How EPA is characterizing TRVs, verified vs approved?

The issue of "approved" versus "verified" is only applicable in the Excel spreadsheet that EPA and the CPG used to vet the alternative TRVs that were developed by the CPG. The spreadsheet may be part of the administrative record but is not part of the BERA. Information was submitted by the CPG to EPA that supported the derivation of the CPG TRVs, and EPA verified that the values and underlying derivations were scientifically accurate; EPA therefore concluded the values could be used as alternative TRVs. During the TRV development and BERA review processes, EPA maintained that EPA's TRVs were more appropriate than the CPG TRVs because they were more conservative (as they were developed by a stakeholder group including EPA) but allowed the CPG to provide alternative TRVs to bound the risk.

As discussed further in EPA's letter to Jay Nickerson dated March 29, 2019, the use of two sets of TRVs for the LPRSA 17-mile BERA is not precedent-setting and is not inconsistent with EPA risk assessment guidance. While both the EPA TRVs and the CPG TRVs were determined to be appropriate for inclusion in the BERA, they were utilized to bound the ecological risk, with the more conservative EPA TRVs providing the lower bound of the risk estimates and the less conservative CPG TRVs providing the upper bound of the risk estimates. Neither of the words "approved" or "verified" is used in the BERA with regard to the TRVs.

NJDEP Response: NJDEP agrees that the TRVs used by EPA for the Lower 8 Mile FFS (thus termed EPA TRVs) are considered more appropriate for this river and should be given preference over CPG's less conservative TRVs for the Upper 9 Miles of the river, where the contaminants and receptors are the same between the lower and upper river regions (OU 2 and OU 4). For this reason, ***this preference should be stated within the BERA*** to provide direction for next-step remedial decision-making. However, despite this stated preference by both EPA and DEP, equal status is apparently afforded to both TRV-A (CPG) and TRV-B (EPA) in the current BERA, indicating "approval" if included within a final approved BERA without this preference stated.

In addition, CPG's presentation of their less conservative TRVs may be interpreted by reviewers as ***preferred*** based on their identification as *TRV-A*, sourced from "the primary literature", versus EPA's TRVs, identified as *TRV-B*, sourced from "...revised draft ...and draft....FFS documents" from 2014 and 2007.

EPA's TRVs should be presented as TRV-A (indicating preference by convention) and identified as sourced from the final BERA and FFS which supported the Lower 8 Mile March 2016 ROD. In addition, the BERA should clearly state preference for use of EPA's TRVs based on: a. the prior extensive TRV vetting process undertaken for the FFS, and b. the presence of listed endangered and threatened species, and/or species of special concern and associated sensitive endpoints of same.

USEPA: Respond to each of the preliminary comments from NJDEP submitted in the March 13, 2019 email from Anne Hayton to Diane Salkie

NJDEP Response: The NJDEP appreciates the information provided in EPA's March 29th letter and has provided a final position (see Attachment B) based on these responses.

USEPA: Review other similar sites, i.e. Kalamazoo

The Kalamazoo Area 4 Supplemental Remedial Investigation (SRI) includes a BERA in which two sets of TRVs were used, However, EPA Region 5 is in the process of finalizing the document. The Upper Columbia River Site includes a draft BERA in which two sets of TRVs were used, but that document has not been finalized by EPA Region 10. EPA HQ has found the use of multiple sets of TRVs to be acceptable, as it is not inconsistent with EPA guidance

NJDEP Response: The NJDEP appreciates the information provided and will be evaluating the circumstances and output (if available) of the dual TRV approach and overall impact on the process for developing risk-based remedial goals. In both cases indicated, the cited BERAs are still draft, indicating ongoing review. If the LPRSA BERA is approved, it will be the first, or among the first, BERAs approved in this way. The DEP team therefore considers this format both potentially precedent-setting, and an unproven process for efficient development of PRGs in the FS.

USEPA: Next call?

EPA believes that this document and the letter to Jay Nickerson dated March 29, 2019 have addressed your questions discussed during our meeting on 3/14/19 and in the email from Jay Nickerson on 3/26/2019. We will respond to any further questions as they arise.

NJDEP Response: Again, NJDEP appreciates the efforts by USEPA's team to address the issues identified above. Recommended next steps:

- Agreement upon the language to go into the BERA as identified above, and
- Discuss and clarify the steps for the IR ROD 1 and ROD 2 as laid out by USEPA's draft process, March 29, 2019.
- Collaboration on development of the needed PRG derivation process and associated document for same, to address sediment and biota tissue of Upper 9 Miles of the LPR, and surface water throughout RM 0 to RM 17.4 of the river.

ATTACHMENT B

NJDEP comments on USEPA's 3/29/2019 response letter regarding NJDEP's 3/13/2019 preliminary review comments on the Revised Draft 3 of the Lower Passaic River Baseline Ecological Risk Assessment (BERA), Oct. 2018

The NJDEP appreciates the USEPA's 3/29/2019 response letter and offers the following comments for the Agency's consideration. Items are numbered in order as they appear in EPA's 3/39/19 response letter, and combined for efficiency:

GENERAL COMMENTS (1-3 and 8)

The names of three riverine Superfund sites were provided where two sets of TRVs have been used in the BERAs. The Kalamazoo River and Upper Columbia River sites are designated as drafts and the status of the Newtown Creek site is not clear. Please provide links for these documents so that the NJDEP can review the risk characterization process in each, and links to Partner Agency comments for those sites.

Regarding resource limitations, please note that NJDEP does not have the ability for contractor assistance for ecological risk assessment reviews, coupled with a higher volume of sites than the number of NJ Superfund sites.

The NJDEP's opinion remains that neither NJDEP's nor USEPA's written guidance specifically addresses the use of more than NOAEL-LOAEL TRV set. The stakeholder committee that authored NJDEP's *Ecological Evaluation Technical Guidance* never envisioned nor intended that more than one TRV set could/would be used.

SPECIFIC COMMENTS

Items 4-7 and 14 – The responses states that "EPA will consider both sets of TRVs when developing risk-based preliminary remediation goals. Any chemical with an HQ that exceeds acceptable levels will be included in the list of chemicals for which PRGs are developed."

Regarding the development of risk based remedial goals, the "BERA Action Item Responses" further states that "EPA will look at both sets of TRVs and assess whether they both can be used to evaluate ecological effects to the Upper 9 miles. If so EPA will evaluate the most applicable methodology (one study value, or a statistically -derived value) and derive goals that are the most appropriate for the biota at the site, based on the endpoints of survival, growth or reproduction."

It remains the NJDEP's position that one NOAEL-LOAEL TRV set, protective of sensitive species and endpoints, should have been determined in the "Risk Assessment and Risk Characterization (RARC)" planning document, which remains "in preparation" (refer to associated NJDEP Memorandum May 7, 2019, Comment 1) and used both in the BERA and for future PRG determinations. For example, see p. 2-2 in the FFS Appendix E, which explains

"Ecological risks were calculated using lower and upper toxicological benchmarks to bound the risk estimates. Sediment PRGs were calculated using the geometric mean of the lower and upper bound benchmarks values, which are based on NOAELs and LOAELs for wildlife dose -based MEs... ." It is the NJDEP's opinion that, for the contaminant-receptor pairs for which PRGs will be developed, that one NOAEL-LOAEL TRV set that is protective of sensitive receptors and endpoints must be used to determine PRGs, in a manner similar to that used in the 2014 FFS, Appendix E. The NJDEP requests that the Partner Agencies be involved in the selection process for TRVs that will be used for PRG development. Again, it is the NJDEP's position that the TRVs used for PRG development and those used in the BERA should be one and the same. The statement in the Action Item Response, that the "EPA will look at both sets of TRVs (during PRG development) and assess whether they both can be used to evaluate ecological effects to the Upper 9 miles" is troubling in that it implies that the TRVs used in the BERA were not necessarily adequate to evaluate ecological effects to the Upper 9 Miles.

Items 9, 11, 12 – no further comments

Items 10 - While exposures between the Upper 9 and Lower 8 reaches may differ due to fresh/saline environments (exposure parameters in numerator of HQ determination), the same avian and mammalian reference doses (TRVs in denominator) apply to both environments.

Items 13– It remains the NJDEP's opinion that "by Reach" HQ results are paramount. Since the spotted sandpiper and heron feed almost exclusively in mudflats, the by-reach HQs for these receptors is linked with specific contaminated mudflats (or multiple mudflats) in each reach. These HQ results and mudflat sediment data in each reach should be carefully examined during Interim Remediation planning.

ATTACHMENT C
Supplemental Comments on the Oct 2018 Baseline Ecological Risk Assessment
Benthic Invertebrate Health Evaluation
NJDEP- BEERA, May 2019

Additional review of the benthic invertebrate evaluations (surface water and tissue) of Section 6 of the draft LPRSA BERA (Version 3, dated October 1, 2018) has been completed. These comments are provided for consideration by the USEPA risk assessment team and for future assessment of site conditions and development of future PRGs and remedial actions for the Lower Passaic River.

1. Benthic Invertebrate Health, Figure 6-1 (page 228) This figure is a schematic flow chart showing how the risk to the LPRSA benthic invertebrate community will be characterized. Three LOEs/Assessment Endpoints (benthic community, macroinvertebrates, mollusks) are to be evaluated and the results of each combined to complete the "Benthic Assessment". However, it is not clear how the results of these three evaluations will be combined to characterize the risk to the LPRSA benthic community – and it does not appear they were combined in the current draft BERA to evaluate potential risks to the benthic community.

2. Surface Water

a. Section 6.2.2, page 255: No surface water data are available above RM 10.2; thus, there are no data for approximately 41% of the study area, resulting in a large data gap. As a result, the "freshwater" area evaluated (RM 4 to RM 17.4) only addresses RM 4 to RM 10.2, and the "estuarine" area evaluated (RM 0 to RM 13) only addresses RM 0 to RM 10.2.
b. Table 6-13, page 257: The BERA did not use the NJ Surface Water Quality Standards (SWQS) as TRVs, and some of the TRV concentrations used were greater than the NJ SWQS, thus potentially underestimating risk. The following exceedances of the NJ SWQS were observed in the near-bottom water samples:

- Mercury – the mean, UCL, and maximum estuarine and freshwater sample concentrations were greater than both the acute and chronic saline and freshwater SWQS;
- Total PCBs - the mean, UCL, and maximum freshwater sample concentrations, and the UCL and maximum estuarine sample concentrations, were greater than the associated chronic saline and freshwater SWQS;
- 4,4'-DDT – the maximum estuarine and freshwater sample concentrations were greater than the chronic saline and freshwater SWQS;
- Dieldrin - the maximum estuarine sample concentration was greater than the chronic saline SWQS;
- Total chlordane - the mean, UCL, and maximum freshwater sample concentrations, and the maximum estuarine sample concentrations, were greater than the associated chronic saline and freshwater SWQS;
- Cyanide – all of the estuarine sample concentrations were greater than the saline acute and chronic SWQS, with the mean, UCL, and maximum freshwater concentration greater than the freshwater chronic SWQS.

No NJ SWQS (ecological acute, chronic) are available for chromium, PAHs, 2,3,7,8-TCDD, and phthalates.

c. Table 6-14, page 266: The acute and chronic NJ SWQS for many of the metals are hardness-based; thus, comparisons with the selected TRVs for these COCs could not be made. Also note the following:

- Copper – the range of TRVs is both lower and higher than the saline acute and chronic SWQS;
- Lead - the range of chronic TRVs is both lower and higher than the freshwater chronic SWQS, and the range of acute TRVs is higher than the freshwater acute SWQS;

- Selenium – no freshwater acute TRV is listed, but there is a freshwater acute NJ SWQS for selenium;
- Silver – the estuarine acute TRV is greater than the saline acute SWQS;
- Total PCBs – the estuarine and freshwater chronic TRVs are greater than the associated chronic NJ SWQS.

The use of the TRVs which are higher than acute and chronic SWQC are potentially problematic for evaluation of surface water conditions as part of this CECRLA process for which ARARs are considered (Federal and State Surface water Standards and Criteria are ARARs).
All other TRVs are less than the acute and chronic NJ SWQS (where available).

3. Benthic Invertebrate Tissue

a. Section 6.3.3.1, page 314 – TRV Uncertainty – General: Text states "[a]dditional evaluation of TRVs will be undertaken in the FS to derive appropriate preliminary remediation goals (PRGs) for the remedial action objectives". Based on recent discussions with USEPA, the path towards PRG development is under discussion; however, these will be developed in a process/document separate from the Interim Action FS.

b. Section 6.3.4, page 337: invertebrate tissue concentration data are apparently not available from the references areas, so comparisons to LPRSA data were not possible; this remains a data gap.

c. Figure 4-16: No samples were collected in the Kearny Point area.

d. Figure 4-17: No samples were collected in the Kearny Point area and between RM 4.5 and RM 10.5.

e. Table 4-3, page 120: It does not appear that any benthic invertebrate tissue data from samples collected in the reference areas were available for use in the BERA.

f. Tables 6-20 and 6-21, page 318: These tables include both benthic invertebrate NOAELs and LOEALs for both sets of TRVs, and Tables 6-22 (page 338) and 6-23 (page 340) calculates HQs using these LOEALs and NOAELs. However, the NOAELs are not discussed or otherwise used in the BERA invertebrate tissue discussion (see Tables 6-25/6-26/6-27/6-28; as well as in the Executive Summary and Section 13) - they appear to simply "disappear" from the BERA without any discussion of why they are not used/considered for risk characterization purposes.

ATTACHMENT D
BERA- Revision 3 Draft – October 1, 2018
Review Comments – Sediment Quality Triad (SQT) Evaluation

The purpose of the BERA SQT evaluation is to establish "ecological risks [to community structure and function; BERA Section ES.1, page ES-1] associated with degraded sediment quality" (BERA Section 6.1, page 232). To do this, the LPRSA Sediment Quality Triad (SQT) evaluation tries to answer two (2) of the "Testable Risk Questions" (BERA Table 3-2):

(a) "Are benthic communities different from those found in similar nearby water bodies, where chemical concentrations are at background levels?" [background defined as "background and reference information"]

(b) "Are COPEC concentrations in LPRSA sediments from the biologically active zone at levels that might cause an adverse effect on survival, growth, and/or reproduction of the benthic invertebrate community?"

If the answer to both questions is "yes", then the assumption is that the observed differences in the benthic invertebrate community are potentially the result of elevated COPEC concentrations in the LPRSA sediment (resulting in toxicity to benthic invertebrates). An underlying assumption is that habitat conditions that could otherwise adversely affect the benthic invertebrate community are comparable in the reference area and associated LPRSA salinity zone samples. If the answer to the first Testable Risk Question is "no", then it can be assumed that different habitat conditions or elevated COPEC concentrations in the LPRSA sediment are not adversely impacting the benthic invertebrate community (or that the benthic invertebrate communities in both the reference areas and the LPRSA are similarly impacted).
"Suitable" reference area data should be available for comparison to the data from the associated LPRSA SQT sediment sample locations to answer the two Testable Risk Questions. To be "suitable", the reference area sediment data must (a) have habitat conditions comparable to the associated LPRSA SQT locations, (b) have COPEC concentrations generally lower than those in the associated LPRSA SQT locations, and (c) not have elevated sediment toxicity test results compared to negative controls. If conditions (a) and/or (b) are not met, it will not be possible – at "impacted" LPRSA SQT locations – to determine if elevated sediment chemistry concentrations and/or different habitat conditions are causing the observed "impacts" to the LPRSA benthic invertebrate community. If condition (c) is not met, it can be assumed that there is a high probability that the reference area benthic invertebrate community is "impacted".
The comments under <u>Suitability of the Reference Area Data</u> result in the conclusion that it has not been demonstrated that the screened reference area sample data (but not necessarily the reference sample areas themselves) are "suitable" (as defined above) for use in the BERA SQT evaluation.

<u>Suitability of the Reference Area Data</u>
General Comment A: the BERA (for example, Section ES 6.3.1, page ES-37) identifies the reference areas to be used for comparison purposes to the LPRSA SQT data – Jamaica Bay (estuarine. urban), Mullica River/Great Bay (estuarine, non-urban), and upstream/above Dundee Dam (freshwater, urban). Data from a freshwater non-urban reference area (for example, freshwater Mullica River) were considered not available for use. *[Note: the Department*

previously commented on the second draft BERA (letter to USEPA-Region II dated April 30, 2018) concerning the need for a non-urban freshwater reference area (i.e. an area comparable to the freshwater Mullica River) to evaluate the potential risk and benthic community impacts resulting from elevated sediment contaminant levels.]
The LPRSA has been divided into three (3) salinity zones with the following associated reference areas:

- "Upper Estuarine" (RM0 to RM4) – Jamaica Bay and Mullica River/Great Bay
- "Fluvial Estuarine" (RM4 to RM13) – Jamaica Bay and Mullica River/Great Bay
- "Tidal Freshwater" (RM13 to R17.4) – above Dundee Dam.

Appendix J and Appendix L-Attachment L2 compare various sediment contaminant and habitat condition parameters (for example, total organic carbon, % fines, and salinity) in the reference area and LPRSA sediment samples. However, these comparisons (a) use the entire available reference area and LPRSA data sets, not the smaller screened reference area (see General Comment B, and Comments #1 and #2) and LPRSA SQT sample location (n = 98) data sets, and (b) did not include statistical analyses comparing the reference area and LPRSA data. Thus, it cannot be concluded that the screened reference area data used in the BERA SQT evaluation are "suitable" (as previously defined) for that use. Statistical analyses are needed to quantitatively compare the physical/habitat condition (for example, % fines, TOC, and salinity) and COPEC concentrations of the screened reference area and associated LPRSA SQT sediment sample data (by salinity zone) to verify that (a) habitat conditions are comparable, and (2) chemistry concentrations are generally lower in each reference area compared to its associated LPRSA salinity zone locations.

[Note: the LPRSA salinity zones used for sampling and testing purposes were different from those used for data analysis and evaluation purposes in the BERA SQT evaluation; this complicates the use and interpretation of the BERA SQT evaluation; see Technical Comment #7.]

General Comment B: Appendix P - Section 2.3 (page 11) states "[r]eference area data are intended to provide a representation of conditions that would be expected in the LPRSA had the release of site-related hazardous substances not occurred". Thus, to the greatest extent practicable, habitat characteristics of each reference area and its associated LPRSA salinity zone should be similar. To develop the reference area data set for use in the BERA SQT evaluation, the available data were screened (Appendix P - Section 2.3.1 and Figure 2-1). First, those samples that had elevated sediment chemistry levels compared to median sediment quality guideline quotients were removed; this would presumably result in reference area samples with COPEC concentrations generally lower than those in the associated LPRSA SQT locations. Second, those samples that had elevated sediment toxicity test results compared to negative controls were removed. It was thereafter assumed that the benthic invertebrate community in the remaining screened reference area samples were not impacted by elevated sediment chemistry levels (resulting in toxicity to benthic invertebrates) or habitat conditions. However, Appendix P recognizes that this reference area sample screening process may result in data that do not fully characterize the reference areas:

- Appendix P, Section 2.3.4 (page 27, Bullet #1): states "[i]t is unclear whether the screened reference area datasets accurately reflect the reference condition. Specifically, screening reference data using sediment chemistry or sediment toxicity criteria imposes a potentially unreasonable constraint on data acceptability. The resulting datasets may not capture the full range of possible benthic community metric [and sediment toxicity test; Section 3.2.5, page 71, Bullet #1] results that should be expected under urbanized conditions (but for the LPRSA-specific release of hazardous materials)."

- The reference area sediment sample screening process resulted in the removal of 19 of the 24 (79%) samples collected above the Dundee Dam from the reference area data used in the BERA SQT evaluation. Appendix P, Section 2.3.1.2 (page 18) states that "[d]ue to its small size [5 samples], there is substantial uncertainty associated with ... the characterization of reference conditions above Dundee Dam"; also see Appendix P, Section 3.2.5 (page 71, Bullet #3). A large percentage of the samples (63%) were also removed from the Jamaica Bay reference area data set (see Comment #4)

General Comment C: evaluations (for example, statistical analyses) have not been conducted to verify that the LPRSA SQT sample locations accurately characterize, and are representative of, the larger LPRSA data sets used in the BERA. For example –

- BERA Section 4.2.1 (page 101), Table 4-2 (page 104), and Figure 4-1: identify LPRSA sediment chemistry samples in addition to those used in the BERA SQT evaluation (the 98 benthic sediment samples collected in 2009; Figure 4-5). It is not apparent how consistent with, and representative of, the BERA SQT sample data (Appendix P) are with this larger BERA data set. Also see Comments #1 and #2.

- BERA Figure 4-5 – LPRSA SQT Sample Locations: what criteria were used to select these sample locations and are these locations representative of the range and composition of the types of benthic habitats in the LPRSA? – see BERA Figure 2-7. For example –

    - Kearny Pt. - only 3 locations, all located in the northeast section of this area, have been used;

    - RM 0 to RM 2.5 – 11 locations have been used along right descending bank, 5 locations in the center of the river, but no locations have been used along left descending bank.

(1) Appendix J, Section 1, page 3: states "[b]ackground data were used to develop a range of values for comparison to data collected from the LPRSA". Background sediment chemistry concentrations were developed in this appendix (Section 2.3, page 10) and compared to LPRSA sediment data for selected chemicals (Section 4, page 51). It appears that the entire (not the screened) reference area data sets and a larger LPRSA data set (not just the LPRSA SQT sample location data) were used in these evaluations. Thus, the

analyses presented in Appendix J may not be appropriate to determine if the screened reference area data used in the BERA SQT evaluation are "suitable" (as previously defined) for that use.

(2) Appendix L-Attachment L2, Section 3, page 6: compares various physical and chemical sediment characteristics of the reference area samples to LPRSA data. However, these comparisons are made using the entire reference area data set, not the screened set of reference area samples used in the BERA SQT evaluation (Appendix P, Section 2.3). Likewise, this comparison uses larger LPRSA data sets for % fines (Figure 3-1: 353 samples), TOC (Figure 3-2: 427 samples), and sediment chemistry (Figures 3-4 through 3-23; variable number of samples) than those used in the BERA SQT evaluation (98 sample locations). Thus, the analyses presented in Appendix L-Attachment L2 cannot be used to determine if the screened reference area data used in the BERA SQT evaluation are "suitable" (as previously defined) for that use.

(3) BERA Table 4-1, page 99: Data Quality Objective (DQO) No. 2 is "Data must represent current conditions". The Jamaica Bay and Mullica River/Great Bay reference area data are not consistent with this DQO. The Jamaica Bay data are from 1993-2005, and the Mullica River data are from 1999-2006 (BERA Section 4.2.1, page 101); the "screened" reference area sample data used in the BERA SQT evaluation may have been collected during shorter intervals within these time periods.

- BERA Section 4.2, page 101: states "[c]omparable sediment chemistry, toxicity, biological survey, and tissue data were not available from Jamaica Bay and Mullica River after 2006 … the use of dated Jamaica Bay and Mullica River data adds some level of uncertainty and may impact the background comparison evaluation". In addition, Appendix P – Section 2.3.4 (page 27, Bullet #2) states "[i]t is unknown whether temporal factors influence the interpretation of [the] reference area data sets … Within reference area datasets, temporal changes should result in invertebrate [as well as sediment toxicity and chemistry] variability".

- BERA Section 4.2, pages 101: also states "only data collected by CPG (under USEPA oversight) since 2007 were considered to be representative of current conditions within the LPRSA"; this criterium for the LPRSA SQT sample data is inconsistent with the data from the Jamaica Bay and Mullica River/Great Bay reference areas, which was collected prior to 2006. *Similar concerns with the age of the reference area sample data have been raised by NOAA in its review of the Revision 2 Draft BERA (memorandum from Reyhan Mehran, NOAA, to Diane Salkie, USEPA, dated April 6, 2018; Comment #10).*

(4) Appendix P, Section 2.3.1, page 14: by removing sample data that were potentially toxic to benthic invertebrates, the reference area data screening process was designed to result in reference area sediment toxicity and chemistry data sets used in the BERA SQT

evaluation that were more "conservative" than the raw/unscreened reference area data (i.e. overall lower levels/frequency of observed toxicity and COPEC concentrations).

- Jamaica Bay - The reference area sediment sample screening process resulted in the removal of 59 of the 94 (63%) Jamaica Bay samples from the reference area data used in the BERA SQT evaluation. However, 17 of the Jamaica Bay samples removed from the reference area data set had elevated chemistry concentrations but greater than 80% survival of *Ampelisca abdita* (i.e. chemistry-toxicity "false positives" were removed from the data; Appendix B, Table B3-4). [A similar analysis could not be conducted for the above Dundee Dam samples given the data in Appendix B, Table B4.]

- Jamaica Bay - Appendix P, Section 3.2.2.1 (page 58) and Appendix B, Table B3-4: 35 of the 94 (37%) Jamaica Bay sediment samples had less than 80% survival of *A. abdita* in the sediment toxicity tests (compared to the negative control). In contrast, 6 of the 27 LPRSA SQT estuarine sample locations (22%; Appendix P, Table 3-1, page 50) had less than 80% survival of *A. abdita.* This indicates that, overall, the Jamaica Bay sediment samples may be frequently more toxic to *A. abdita* than the LPRSA estuarine SQT samples (and thus potentially not a suitable reference area, as defined above).

(5) The reference area habitat condition data used in the BERA SQT evaluation should be comparable to that in their associated LPRSA Salinity Zone SQT samples. This was evaluated in Appendix L-Attachment L2 for the entire LPRSA (not just the SQT locations) and reference area data; see Comment #2. Technical Comment #1 indicates that the habitat condition data (sediment grain size, TOC, and salinity) in the screened reference area and associated LPRSA SQT sediment samples may not be comparable. Thus, it may not be possible to determine if elevated COPEC concentrations and/or different habitat conditions are the potential cause(s) of (i.e. "risk to") any observed impacted benthic invertebrate communities in the LPRSA -

(6) The sediment COPEC levels in the reference area sample data used in the BERA SQT evaluation should be consistently less than those in their associated LPRSA Salinity Zone SQT samples. This was evaluated in Appendix L-Attachment L2 for the entire LPRSA (not just the SQT locations) and reference area (unscreened) data; see Comment #2. Technical Comment #2 indicates that sediment COPEC levels may not be consistently higher in the LPRSA SQT sample data compared to the screened reference area sample data.

<u>Benthic Invertebrate Community LOE Evaluation</u>
Testable Risk Question: "Are benthic communities different from those found in similar nearby water bodies, where chemical concentrations are at background levels?" [background defined as "background and reference information"]

General Comment D: to address this Testable Risk Question, Appendix P (Section 2.3.2, page 21) compares the screened reference area sample data to the LPRSA SQT sample data for a

variety of benthic invertebrate community metrics. Statistically significant differences (Mann-Whitney U test) were observed between the LPRSA SQT and associated reference area sample data for almost all the metrics/comparisons (Table 2-7: abundance, taxa richness, H', J', and SDI; but not HBI). Appendix P Table 2-8 (page 26) shows that varying percentages of the LPRSA SQT sample locations were outside the reference area statistical envelopes (5-95%) for each of the benthic invertebrate community metrics.
Appendix P, Section 2.3.2 (page 22) concludes that "in general, the benthic invertebrate community in the LPRSA is impaired relative to communities found in reference areas". This conclusion is consistent with the results of the analyses presented in Table 2-7 (page 21) and Table 2-8 (page 26). However, Section 2.4 (page 42) states inconsistent conclusions and appears to focus on those (fewer number of) metrics which were not different between the LPRSA and the reference areas, compared to those (greater number of) metrics which were different –

- Upper Estuarine – "the benthic community in the upper estuarine salinity zone is somewhat different" from the associated reference areas;
- Fluvial Estuarine – "most of the community metrics for the fluvial estuarine zone are significantly different …[but] location-specific differences are sometimes minor and inconsistent across multiple metrics";
- Tidal Freshwater – "the benthic community in the tidal freshwater LPRSA are frequently impaired".

Thus, based on the evaluations presented in Appendix P, it does not appear that the BERA has definitively concluded that the benthic invertebrate community in the LPRSA SQT Upper Estuarine and Fluvial Estuarine salinity zones are distinctly different (and thus presumably "impaired/stressed") from those in the Jamaica Bay and Mullica River/Great Bay reference areas. To further evaluate and compare the LPRSA SQT and reference area benthic invertebrate communities, see Comments #7 and #8.

(7) Appendix P presents data on the higher-order taxa composition of the screened reference area sample data (Figures 2-2, 2-3, and 2-4), with similar data for the LPRSA SQT sediment samples presented in the BERA (Section 2.2, page 45). However, a comparison of the taxa composition of the LPRSA SQT and associated reference area sample data apparently has not been completed. Such a comparison may identify significant differences, including the presence of "impaired/stressed" benthic invertebrate communities in the LPRSA SQT samples associated with "indicator" taxa. In the context of the BERA, such an evaluation may provide additional insight into the potential effects (i.e. "risk") of contaminant levels, varying habitat conditions, etc. on the communities.

(8) Appendix P, Section 2.3 (page 11, Bullet #2): the use of the reference area statistical envelope method to determine if the benthic invertebrate community at the LPRSA SQT locations are "stressed" assumes that the reference area benthic invertebrate communities are not "impacted/stressed". Completion of the evaluation recommended in Comment #7 should provide additional information regarding the relative condition of the LPRSA SQT and associated reference area benthic invertebrate communities.

(9) Appendix P, Table 4-1, page 94: What is the basis for the reduced lists of COPECs used in the bivariate correlation analyses (apparently provided to the CPG by USEPA Region 2 – see Section 4.1.1, page 93)? The reduced list of COPECs used for the site-wide bivariate correlation analyses do not include PCDDs/PCDDFs and total TEQ, dieldrin, and copper; these were COPECs in the LPSRA 0-8 mile ROD. The omission of PCDD/Fs is a significant limitation on the use of the results of the correlation analyses. In addition, the Tidal Freshwater COPEC list does not include PCDDs/PCDDFs and total TEQ, as well as any metals. Also, why were separate bivariate correlation analyses not conducted for the Upper Estuarine and Fluvial Estuarine salinity zones?

(10) Appendix P, Section 4.2.1, page 108: states "[a]part from correlations between metals and HBI, coefficients of variation [in the bivariate analyses; Tables 4-2 and 4-3] … are quite low ($r^2 < 0.31$) for all significant relationships". Given the multiple potential (and interacting) causes of toxicity and factors affecting benthic community structure, these "low" correlation coefficients are not unexpected. Thus, the conclusion that "single chemical-benthic response relationships are unreliable for predicting ecological risks to benthic invertebrates throughout the LPRSA based on sediment chemistry data alone" appears to be supported by the results of the bivariate correlation analyses. This conclusion also supports the position that the T50 LOE, as used in the BERA SQT WOE, is inappropriate (see General Comment E).

(11) Section 4.1.2.1, page 94: the description of the multivariate analyses suggests that reference area data – as well as the LPRSA SQT sample data - were used; how (and why) reference area data were used in the multivariate analyses should be explained. Since the multivariate analyses were "applied to the LPRSA data in an effort to evaluate potential relationships among sediment chemical concentrations, habitat conditions, and measurable benthic responses" (Section 4.1.2, page 94), the use of reference area data in the analysis would appear to be inappropriate.

- Page 95, Footnote 29: Given that the references area data were screened for use in the sediment toxicity and benthic invertebrate community components of the BERA SQT evaluation, use of a different set of reference area data in the multivariate analysis complicates the interpretation of the results in the context of the BERA SQT evaluation.

(12) Appendix P, Table 4-4 (page 112) and Table 4-5 (page 116): the Adjusted r^2 and Predicted r^2 values for most of the Method 1 and Method 2 MLR models are positive. This indicates an overall positive relationship between the model endpoints and the chemistry and habitat parameters used in the models. These results seem potentially reasonable if the habitat parameters are the dominant factors affecting the model results but are counterintuitive if the COPEC parameters are the dominant factors. This could be (partly) the result of the transformations and normalizations made to the chemistry data used in the models (see Technical Comment #20) and/or the inclusion of the reference area data in the analyses (see Comment #11). To evaluate this further, the MLR model coefficients must be provided (they are not included in Table B2).

- Appendix P, Section 4.2.2.3, page 119: states "[s]ediment chemistry was nearly always an important factor in the selected MLR models, with few exceptions". Also, "sediment chemical factors and total fine-grained sediment appeared to be the dominant explanatory variable(s)". These conclusions cannot be verified pending a review of the model coefficients.

- As an example of a counterintuitive chemistry effect, the "Notes" section of Appendix P, Table 4-4 (page 113), *C. dilutus* survival and biomass, states "F3 [primarily organochlorine pesticides] is positively related to survival [and biomass]".

Sediment Toxicity LOE Evaluation

Testable Risk Question: the BERA SQT does not include a question directly concerning sediment toxicity. The results of sediment toxicity tests are used in three (3) ways: (a) in the various correlation analyses with the sediment chemistry and habitat condition (TOC, % fines) data, (b) for comparison purposes with reference area sample toxicity data, and (c) as an ecological risk LOE in the BERA SQT WOE evaluation.

(13) Appendix P, Section 3.1, page 46: states that the LPRSA SQT "[s]amples were considered estuarine or freshwater for the purpose of sediment toxicity testing based on the interstitial water salinity at the time of sample collection". As a result, 27 LPRSA SQT locations were considered "estuarine" and 71 "freshwater" for the sediment toxicity testing, although a much larger proportion of the LPRSA (RM0 to RM13) is considered estuarine (Upper Estuarine and Fluvial Estuarine salinity zones). It is also noted that this designation of the sediment samples for toxicity testing is not consistent with the established LPRSA salinity zones (see Technical Comment #7), and thus also with the associated sediment chemistry and benthic invertebrate community data. Also see Technical Comment #3.

(14) The use of the *Chironomus dilutus* 10-day survival toxicity test data in the BERA SQT evaluation appears to be problematic:

- *C. dilutus* does not appear to be a "sensitive" indicator of sediment toxicity in the LPRSA. While only 35% of the *C. dilutus* 10-day survival LPRSA SQT test locations were significantly different from negative laboratory controls (i.e. were toxic), 70-94% of the LPRSA SQT locations in the other toxicity tests (survival, biomass) were significantly different (Appendix P, Table 3-2, page 54).

- The statistical analysis results in Appendix P, Table 3-5 (page 61) show that the LPRSA SQT and reference area *C. dilutus* survival and biomass data were not significantly different. However, this may be a "false negative" result for the biomass data (p=0.0522; see the following bullet).

- Appendix P, Table 3-6 (page 69) reports that only 18% of LPRSA SQT samples were outside the Reference Envelope Threshold for *C. dilutus* survival compared to 82% of the locations for biomass. Appendix P - Section 3.2.5 (page 72, Bullet

#3) notes that *C. dilutus* frequently emerged or pupated in the samples (including the laboratory controls), potentially affecting the results of the biomass toxicity tests (i.e. decreasing the biomass – see Appendix P, Figure 3-7, page 74);

- Appendix P, Table 4-2, page 107: *C. dilutus* survival and biomass were not significantly correlated with any of the COPECs in the bivariate analyses, while *C. dilutus* weight was only negatively correlated with lead, mercury, and zinc.

(15) The use of the *Hyallela azteca* 28-day survival and biomass toxicity test data in the BERA SQT evaluation may be problematic:

- Appendix P, Section 3.2.2.1, page 58: *H. azteca* toxicity test data from above Dundee Dam (freshwater) were used as the reference area data for the LPRSA SQT estuarine locations. This comparison is not appropriate.

- Appendix P, Section 3.2.3.1, page 61: states "[b]iomass of *H. azteca* in acceptable reference samples from above Dundee Dam ranged from only 36 to 47% of the negative control, indicating a fairly substantial growth effect on this test species that was unrelated to LPRSA-specific chemical contamination". Together with the large number of above Dundee Dam samples removed by the reference area screening process (see General Comment B – Bullet #2), this observation further indicates that (a) the Passaic River above Dundee Dam may not be a good ("unimpacted") reference area data set for the Freshwater LPRSA salinity zone, and/or (b) *H. azteca* may not be a suitable sediment toxicity test species for use in the BERA SQT evaluation.

(16) Appendix P, Section 3.2.1.2, page 54: states "it can be concluded that LPRSA sediments are toxic relative to clean, controlled sediment conditions (i.e., laboratory negative controls)". However, this is "conditioned" on page 56, which states "LPRSA sediment is different from negative control sediments in terms of both contamination by hazardous substances and the sediment matrix. Therefore, it is unclear whether significant differences from the negative control are caused by hazardous substances"; also see Section 3.2.5, page 74, Bullet #3. This may also be an issue when comparing the LPRSA SQT and reference area sample data – see the comments under Suitability of the Reference Area Data.

(17) Appendix P, Section 3.2.2, page 57: states the "reference area toxicity data represents a baseline level of toxicity for the LPRSA in the absence of the release of site related hazardous substances"; However, see Comment #6 – it has not been demonstrated that COPEC concentrations in the screened reference area samples used in the BERA SQT evaluation are generally lower than those in the LPRSA SQT sediment samples.

(18) Appendix P, Section 3.2.4, page 70: concludes "it appears that LPRSA sediments are often toxic relative to reference conditions, but that uncertainty still exists for the LOE due to inconsistent results across toxicity endpoints". This lack of consistency (see below) may be due to how the sediment toxicity data has been evaluated (see Comment

#13) and the use of test species that have been shown to be potentially "problematic" (see Comments #14 and #15).

- In general, the sediment toxicity tests were inconsistent predictors of "impacted" LPRSA benthic invertebrate communities (compared to the associated refence area statistical envelopes; Appendix B, Table B8-1):
    - LPRSA SQT Estuarine samples (n = 27) – 13 of the samples did not have consistent benthic invertebrate community impact and sediment toxicity test results;
    - LPRSA SQT Freshwater samples (n=70) – 37 of the samples did not have consistent benthic invertebrate community impact and sediment toxicity test results (30 had "positive" toxicity test results but the benthic invertebrate community was not "impacted".

BERA WOE SQT Evaluation

General Comment F: The purpose of the BERA SQT evaluation is to establish "ecological risks associated with degraded sediment quality" (BERA Section 6.1, page 232). Sediment chemistry and toxicity data are potential indicators of degraded sediment quality and ecological risk to the benthic invertebrate community. The benthic invertebrate community metrics are indicators of the "health" of the community but are not themselves indicators of ecological risk. Presumably, "impaired/stressed" LPRSA SQT locations (based on invertebrate community metrics) will be frequently associated with indicators of degraded sediment quality (sediment chemistry and toxicity test data). Thus, inclusion of the benthic invertebrate community metrics in the BERA SQT WOE approach produces a partially tautological result.

In addition, the BERA SQT WOE approach does not include potential habitat condition factors (including % fines, TOC, and salinity) that are indicators of degraded sediment quality and ecological risk to the benthic invertebrate community. These were not included despite the significant negative correlations that were observed between % fines and TOC (salinity was not analyzed) and various invertebrate benthic community metrics and sediment toxicity test results (see Comment #5). In addition, BERA Section 6 (page 230) states "[t]through multivariate analysis, it was determined that 10 of 11 measurement endpoints were negatively associated with sediment chemical concentrations, and that habitat conditions [TOC and % fines] had negative associations with several measurement endpoints".

Given the above-stated purpose of the BERA SQT evaluation, it would be appropriate to assign greater weights to those LOE, and parameters within each LOE, that are better/more frequent indicators of "ecological risk" and degraded sediment quality – i.e. are more frequently associated with "impacted" benthic invertebrate community metrics. However, the BERA SQT evaluation does not do that. Each LOE (benthic invertebrate community, sediment chemistry, and sediment toxicity) was assigned a weight of 1.0, with the various parameters contributing to each individual LOE also assigned equal weights that summed to 1.0 (BERA Tables 6-2 and 6-3, page 233). At each LPRSA SQT location, if a parameter exceeded its associated reference area

envelope, the weight for that parameter was included in the sum for that LOE; the magnitude of that exceedance was not considered when assigning a weight.
In its review of the Revision 2 Draft BERA (memorandum from Reyhan Mehran, NOAA, to Diane Salkie, USEPA, dated April 6, 2018; Comments #3 and #4), NOAA also raised a variety of concerns with the equal weighting of the benthic invertebrate community metrics and sediment toxicity results in the BERA SQT evaluation, as well as the parameters included in the evaluation; the Department has similar concerns.

- Sediment Chemistry: BERA Section 6.1 (page 232) notes that "sediment chemistry tends to be considered a weaker LOE within the SQT paradigm". See General Comment E – the use of T50 sediment quality guideline values do not contribute to the discrimination/identification of "ecological risk associated with degraded sediment quality". Every LPRSA SQT location was assigned a value of 1.0 for the sediment chemistry LOE, despite that some COPECs had significant negative correlations with some of the benthic invertebrate community metrics and others did not (Appendix P, Table 4-2, page 107). General Comment E also proposes an alternative approach to weigh the sediment chemistry data.

- Sediment Toxicity Test Results: Comments #14 and #15 note potential problems with using the *C. dilutus* and *H. azteca* sediment toxicity test data. Appendix P, Table 3-5 (page 61) reports that significant differences between LPRSA SQT and associated reference area sediment toxicity test results were only observed in two (2) test comparisons; however, see Comment #14 – Bullet #2, Comment #15 – Bullet #1, and Comment #18. These factors should be considered when applying weights to the individual sediment toxicity test result data.

- Benthic Invertebrate Community Metrics: LPRSA SQT locations within a salinity zone (Appendix P, Table 2-13) and individual LPRSA locations (Appendix P, Table 2-14) are considered "impacted/unimpacted" based on comparisons to the associated reference area data (Mann Whitney U Tests and the reference area envelope approach, respectively). Statistically significant differences (Mann-Whitney U test) were observed between the SQT sediment samples in each of the LPRSA salinity zones and the associated reference areas for almost all the benthic invertebrate community metrics/comparisons (see General Comment D). Appendix P, Table 2-14 (page 40) reports that varying percentages (usually less than 50%) of the LPRSA SQT sediment samples in each salinity zone were outside of the associated reference area envelopes for the invertebrate community metrics. However, Appendix P, Section 2.3.2 (page 22) concludes that "in general, the benthic invertebrate community in the LPRSA is impaired relative to communities found in reference areas". For risk assessment purposes, the BERA SQT WOE should estimate the "probability" that "impacted" LPRSA SQT locations are the result of/indicated by elevated COPEC concentrations and/or stressful habitat conditions. Therefore, the habitat condition parameters (for example % fines, TOC, salinity) should also be used

in the BERA WOE evaluation, and the benthic invertebrate community metrics should not (Table 4-2 of Appendix P).

(19) BERA Section 6, page 230: based on the analyses and evaluations conducted in Appendix P, concludes "[i]t is likely that the observed benthic invertebrate impacts were the result of exposure to multiple LPRSA-related COPECs, and these impacts were likely exacerbated by habitat conditions. Based on this conclusion, the sediment chemistry LOE is included in the overall WOE evaluation in the BERA risk characterization". As noted above, inclusion of the sediment chemistry LOE (in its present form) had no effect on the BERA SQT WOE evaluation. In addition, habitat conditions were not included in the BERA SQT WOE approach.

(20) BERA Section 6.1.1.2 and Table 6-5, page 235: what is the basis (assumptions used) for classifying quantitative data (i.e. the ranges of WOE "total weights" at each LPRSA location) into qualitative (and somewhat arbitrary) categorical levels of "no/low/medium/high impact" (i.e. risk), with further divisions into locations of "Likely low impact" and "Likely impacted" (BERA Section 6.1.2.2, page 238 and Figures 6-3 and 6-4)? These qualitative terms imply differences in the levels of risk that may not be "real"; at a minimum, such terms should be used in the context of "potential impact". General Comment F notes that "impacted" LPRSA SQT locations can be identified by comparing the LPRSA SQT and reference area benthic invertebrate community metrics data. The question then is: are "impacted" benthic invertebrate communities potentially the result of degraded sediment quality (as reflected in sediment chemistry, toxicity test results, and/or habitat condition data)?

- BERA Figures 6-3 and 6-4: it may be more informative (and appropriate) to show the "total weight" at each LPRSA SQT location to identify "areas of greater/lesser concern" of potential risk to benthic invertebrates in the river.

(21) BERA Section 6.1.2.2, page 238 and Figure 6-2: include habitat conditions – total fines, TOC, and total ammonia (but not salinity) - in the further evaluation of the "medium impact" LPRSA SQT locations. Habitat conditions were considered "stressful" if various criteria for these three habitat parameters were exceeded. These criteria were applied in a qualitative manner in this "secondary" analysis only at LPRSA SQT locations where (revised) sediment chemistry and toxicity screening criteria had been exceeded; these habitat condition criteria were not incorporated into the "main" BERA SQT WOE evaluation. In addition, ammonia levels were not evaluated as a habitat condition potentially affecting benthic invertebrate communities in the Appendix J and Appendix L – Attachment L2 analyses.

(22) BERA Section 6.1.4, page 254, Bullet #1: concludes "the percentage of benthic invertebrate communities with a WOE score classified as in the high-impact category ranged between 1 and 19%, and the percentage of benthic communities classified as having a limited impact (combination of no- and low-impact classifications) ranged between 19 and 75%". As noted in Comment #20, these "qualitative impact"

classifications (i.e. the ranges of WOE scores) appear to be arbitrary. In addition, taking a conservative approach that if at least one (1) invertebrate community metric at an LPRSA SQT location is outside its associated reference area envelope that location should be considered "impacted", the results presented in Appendix P, Table 2-8 (page 26) suggest that a minimum of approximately 50% of the LPRSA SQT locations could be considered "impacted" by degraded sediment conditions. This percentage is generally consistent with the conclusion in BERA Section ES.1.2 (page ES-13) that "impacts (medium, likely, or high) were observed at 63% of [LPRSA] SQT locations".

- BERA Section ES.1.2, page ES-13: the percentages of the LPRSA SQT locations in the various "impact classes" reported in this section of the BERA are different from those in the above-noted quote from BERA Section 6.1.4. BERA Table ES-3 is the same as BERA Table 6-8 (page 241). Thus, the conclusions of the BERA SQT WOE evaluation do not appear to be clearly and consistently stated.

Technical Comments

(1) See Comment #5: it has not been demonstrated that the screened reference area habitat condition data used in the BERA SQT evaluation are comparable to that in their associated LPRSA Salinity Zone SQT samples.

- Sediment Grain Size: the data in Appendix L-Attachment L2 Figure 3-1 (page 7) indicates that the grain size (% fines) of the LPRSA Upper Estuary samples may differ from those collected in Jamaica Bay and Mullica River/Great Bay (while the LPRSA Fluvial Estuary samples may have similar % fines). Appendix L-Attachment 2, Section 2.1 (page 3) states that "the grain size data from the upper estuary in the LPRSA differed from that of Jamaica Bay". [However, Section 3.1 (page 6) states "total fines and TOC appear to be generally similar".]

- Sediment Grain Size: Appendix P - Section 2.3.4 (page 29, Bullet #1) suggests that the grain size of the sediment in the samples collected above Dundee Dam varied (at least in part) from that of the Tidal Freshwater LPRSA salinity zone.

- Sediment Grain Size: Appendix P, Table 4-2 (page 107) – significant negative correlations were observed between % fines and invertebrate community abundance, taxa richness, and H', while a significant positive correlation was observed between % fines and *A. abdita* survival, in the LPRSA site-wide bivariate correlation analyses. In contrast, in the Tidal Freshwater salinity zone analysis (Table 4-3, page 10), % fines and abundance were positively correlated, while % fines and *H. azteca* survival were negatively correlated. These observations highlight the (potentially variable) importance of sediment grain size to the benthic invertebrate community, and thus the need to ensure that it is comparable in the screened reference area and associated LPRSA SQT sediment samples.

- Total Organic Carbon: the data in Appendix L-Attachment L2 Figure 3-2 (page 8) indicate that the TOC levels in the LPRSA Upper Estuary and Fluvial Estuary samples may differ from those collected in Jamaica Bay and Mullica River/Great

Bay. In addition, Section 2.2 (page 4) states that "[m]edian sediment TOC in the Mullica River/Great Bay sediment samples were generally lower than TOC measured in LPRSA sediment samples …"

- Total Organic Carbon: Appendix P, Table 4-2 (page 107) – significant negative correlations were observed between TOC and invertebrate community abundance, taxa richness, H', J', SDI, and *H. azteca* weight/biomass/survival in the LPRSA site-wide bivariate correlation analyses. In contrast, in the Tidal Freshwater salinity zone analysis (Table 4-3, page 10) only H' and TOC survival were negatively correlated. These observations highlight the (potentially variable) importance of TOC to the benthic invertebrate community, and thus the need to ensure that it is comparable in the screened reference area and associated LPRSA SQT sediment samples.

- Salinity: Appendix L-Attachment 2 - Section 3.1 (page 6) concludes that "salinity appears to be quite different across [the] datasets (Figure 3-3 [page 9]) ... Jamaica Bay surface water samples have relatively stable and greater salinity relative to interstitial salinity in the LPRSA estuarine zones. Mullica River/Great Bay surface water samples … [also] have greater interstitial salinity than samples from comparable LPRSA zones." The data in Figure 3-3 (page 9) indicate that salinity in the Jamaica Bay and Mullica River/Great Bay estuarine samples appear to be much greater (about 15 ppt on average) than those from the LPRSA

- Salinity: Appendix P, Section 1 (page 1): notes that the LPRSA salinity data are from sediment porewater samples, while the reference area salinity data are from surface water samples. Further, it is stated that "[s]alinity in porewater and surface water may be slightly or significantly different … This remains a point of uncertainty for comparisons of salinity data …"

- Salinity: Appendix P, Section 2.2 (page 4): in contrast, states that the "range in salinity [for Mullica River/Great Bay] is similar to that observed in the LPRSA". The data in Figure 3-3 (page 9) indicate that, while the salinity ranges in the LPRSA Upper Estuary and Mullica River/Great Bay samples overlap, the 25%-75% "boxes" do not – thus, this overlap may be due to "outliers" in the data. In addition, the Mullica River/Great Bay salinity range does not overlap with that of the LPRSA Fluvial Estuary data.

- Salinity: Appendix P, Section 4.2, page 106: salinity was not a factor analyzed in the bivariate correlation (and multivariate; Section 4.2.2, page 110) analyses. However, BERA Section 2.2.1.1 (page 50) states the LPRSA SQT data "suggests that salinity (and its daily variation) plays a major role in structuring benthic communities throughout the LPRSA".

- Appendix L-Attachment 2, Section 2.1 (page 3) and Section 2.2 (page 4): note that the more extensive salt marsh and submerged aquatic vegetation (SAV) habitats in Jamaica Bay and Mullica River/Great Bay, compared to the LPRSA, may be reflected

in differences in observed benthic invertebrate community structure, diversity, and taxa.

(2) See Comment #6: it has not been demonstrated that the sediment COPEC levels in the screened reference area sample data used in the BERA SQT evaluation are consistently less than those in their associated LPRSA Salinity Zone SQT samples.

- Appendix L-Attachment L2, Section 3.2, page 6: states "[s]ediment chemistry concentrations in the LPRSA generally exceed concentrations in regional reference areas… although not always".
- A review of the data in Appendix L-Attachment L2 Figures 3-4 through 3-23 indicates that the concentrations of the contaminants for which data are presented appear to be similar in the samples collected above Dundee Dam and in the LPRSA Tidal Freshwater zone, with lower concentrations in the Mullica River/Great Bay samples.
- Appendix L-Attachment L2, Figures 3-4 through 3-23: very limited (or no) sample data are available from Jamaica Bay and/or Mullica River/Great Bay for comparison purposes with the LPRSA SQT sediment data for the following chemicals - methyl-mercury, PCB-TEQ bird, PCB-TEQ mammal, total PCB congeners, total TEQ-bird, total TEQ-mammal, and vanadium. Thus, it is not possible to conclude that concentrations of these chemicals are lower in these reference areas compared to the associated LPRSA estuarine salinity zone samples.
- Appendix L-Attachment L2, Figures 3-4 through 3-23: when an adequate number of Jamaica Bay and Mullica River/Great Bay reference area samples are available, concentrations in these samples appear to be comparable to, or greater than, those in the LPRSA Upper Estuary and Fluvial Estuary samples for the following chemicals – selenium, vanadium (but see the previous bullet), arsenic, cadmium, chromium, and copper.
- Appendix P, Table 4-2, page 107): multiple significant negative correlations were observed between COPECs and various sediment toxicity test results and benthic invertebrate community metrics in the LPRSA site-wide bivariate correlation analyses. In contrast, in the Tidal Freshwater salinity zone analysis (Table 4-3, page 10), fewer significant correlations were observed.

(3) See Comment #14:

- Appendix P, Figure 3-1: shows that almost all the "estuarine" sediment toxicity locations were located below RM 4 (i.e. in the Upper Estuarine salinity zone). Thus, the comparison of the "estuarine" LPRSA sediment toxicity data with the associated reference area estuarine data (for example, see Appendix P, Table 3-5, page 61) is largely limited to data from the LPRSA Upper Estuarine salinity zone.

- Only 19 of the 71 "freshwater" sediment toxicity locations were located above RM 13 (the Tidal Freshwater salinity zone; Appendix P, Figure 3-1). Thus, the comparison of the "freshwater" data with the above Dundee Dam reference area data (for example, see Appendix P, Table 3-5, page 61) is largely a comparison of estuarine samples (from the Fluvial Estuarine salinity zone) with a freshwater reference area.

- While the estuarine/freshwater designation was based on a salinity threshold of 5 ppt, the *Hyallella azteca* used in the 28-day estuarine tests were acclimated to 10 ppt salinity.

(4) It is not clear what type of box and whiskers plots are used in the Appendix L-Attachment L2 figures.

(5) Comment #10 in the previously referenced April 2, 2018 memorandum from Rayhan Mehran (NOAA) to Diane Salkie (USEPA) noted that most of the Jamaica Bay sediment samples were collected at a depth of 0-2 cm, which is inconsistent with the 0-15 cm depth to which the LPRSA SQT sediment samples were collected.

- In addition, while the Jamaica Bay and Mullica River/Great Bay reference area samples were collected from a 0.04 m^2 area and processed using a 0.5-mm sieve, the LPRSA RM0 to RM 8.5 estuarine samples (to which they were compared) were collected from a 0.1 m^2 area and processed using a 1-mm sieve (Appendix P, Section 2.1, page 3). Appendix P, Section 2.3.4 (page 28, Bullet #1) notes that "the difference in sieve sizes used … could have influenced sample abundance and taxa richness".

(6) Appendix J, Table 3-4, page 23: the process used to remove outliers (Section 2.3, page 10) from the background sediment data sets to develop the background sediment data presented in Table 3-1 (page 11) can result in a decrease in the maximum detected concentration and UCL of a variety of chemicals by more than an order of magnitude. This process may result in "false" differences between the resulting background data and the associated LPRSA salinity zone data.

(7) Appendix P, Section 2.1, page 3: the LPRSA "salinity zones" used for sampling and testing purposes were different from those used for data analysis and evaluation purposes in the BERA SQT. While RM8.5 to RM13 was sampled/tested using freshwater methods, the data were analyzed as part of the Fluvial Estuarine salinity zone. This complicates the use and interpretation of the BERA SQT evaluation –

	Sampling/Testing Methods	Data Analysis/Evaluation	
RM0 to RM8.5	Estuarine	RM0 to RM4	Upper Estuarine
		RM4 to RM 13	Fluvial Estuarine
RM8.5 to RM17.4	Freshwater	RM13 to RM17.4	Tidal Freshwater

- BERA Section 2.1.1.1 (page 18) and Section 2.2.1 (page 45): the revised salinity zones used in the BERA were based on the low flow conditions present in 2009

when the benthic invertebrate community sampling occurred. These salinity zones may therefore not represent "average" or "long-term" conditions in the LPRSA. Thus, their use to analyze the LPRSA SQT data are a source of uncertainty in the risk analysis.

- BERA Section 2.2.1.1, page 46: states "all [seasonal] surveys indicated similar trends in terms of [LPRSA] species counts and benthic community structure". However, BERA Section 2.2.1.2 discusses observed seasonal trends in the relative abundance of the major benthic taxa, and states (page 51) "[t]he distributions of polychaetes and oligochates (the dominant taxa) tracked the seasonal trends in interstitial salinity" and (page 53) ""[t]he seasonal shift in diversity is likely related to changes in seasonal freshwater flow and confirms the impact of saltwater migration on benthic community metrics".

(8) Appendix P, Section 2.2.2, page 10: the use of kick nets to collect three (3) samples in the LPRSA Tidal Freshwater zone resulted in the collection of different kinds of organisms compared to the grab samples collected at other locations in this LPRSA salinity zone. This is probably the result of both the type of habitats sampled and the sampling methods used (see Footnote 7 on page 11). However, it also suggests that (at least in some areas) the LPRSA benthic invertebrate community may not have been comprehensively characterized.

(9) Appendix P, Section 2.3.1, page 14, para. #1: to further evaluate the "suitability" of the selected reference areas/data for use in the BERA SQT evaluation, the referenced document by Windward and AECOM (in prep) should be provided to the Department for its review.

(10) Appendix P, Section 2.3.1, page 14: this section states that the screening process did not remove any Mullica River/Great Bay estuarine samples (n = 12) from the reference area data used in the BERA SQT evaluation. However, a review of Appendix B Table B3-4 shows that 5 of the 17 Mullica River/Great Bay samples with "full SQT data" were removed by the screening process.

(11) Appendix P, Section 2.3.4, page 27: qualitatively discusses a wide variety of factors that could have affected the comparison of the LPRSA SQT and reference area benthic invertebrate community data. However, how these factors may have affected the comparisons – making the observed difference less or more likely to be "real"" – is generally not discussed.

(12) Appendix P, Section 3.1, page 49: were the reference area data also normalized to its negative control data? If not, this may make the comparison of the LPRSA sediment toxicity data with the reference area data less "conservative".

(13) Appendix P, Section 3.1 (page 49) and Section 3.2.5 (page 74, Bullet #2): the Department previously commented on the second draft BERA (letter to USEPA-Region II dated April 30, 2018) concerning the variation of the Ampelisca abdita sediment toxicity

test procedure used in the BERA SQT evaluation. The Department's concerns with this revised test procedure have not been addressed in the revised version 3 BERA.

(14) Appendix P, Section 3.2.2, page 57, Footnote 20: references Attachment L3 – should this be Attachment L2? If so, see the comments under Suitability of Reference Areas. Otherwise, please provide Attachment L3. Likewise, see Section 3.2.5, page 70, Bullet #1.

(15) Appendix P, Section 3.3, page 89, para. #3: *A. abdita* survival was also statistically significantly lower in the LPRSA SQT estuarine sediment – see Tables 3-5 and 3-6.

(16) Appendix P, Figure 3-2: given the figure legend and the way the data are presented, it is difficult to distinguish "toxic/non-toxic" test results. However, it appears that every LPRSA SQT sediment sample showed at least one "toxic" result compared to the laboratory negative control data for that test.

(17) Appendix P, Figure 3-3: includes eleven (11) *A. abdita* sediment testing locations between ~ RM 4 and ~RM 6 that are not included in Figure 3-6.

(18) Appendix P, Figure 3-6: the following approximate reaches of the LPRSA had "groups" of sediment locations with *A. abdita* survival outside the reference envelope - (1) north-central area of Kearny Pt., (2) RM 1.5 to RM 2, and (3) RM 2.8 to RM 4.2. Potential correlations with elevated COPEC concentrations and atypical habitat conditions should be evaluated in these reaches of the LPRSA.

(19) Appendix P, Section 4.1.1, page 92: states "[t]he results of the correlation analyses were used to inform conclusions from the WOE analysis outlined in Section 6.1 of the BERA". However, the results of the correlation analyses were not used in this manner.

(20) Appendix P, Section 4.1.2.1, page 95: the chemistry data were log-transformed and "centered to the mean and scaled to units of standard deviation" (i.e. normalized) for use in the multivariate analyses. The results of the multivariate analyses must be interpreted accordingly (i.e. not in terms of COPEC concentration units).

- The 30 COPECs used in the Method 1 multivariate analysis should be clearly identified.
- The lack of total PCB (and presumably PCDD/PCDF and total TEQ – see Comment #9) data is a significant limitation on the use of the results of the Method 1 multivariate analyses. Note that total PCBs were included in two of the Method 2 Exploratory Factor Analysis Loading Factors (F1 and F5; Appendix P, Section 4.2.2.2, page 115).

(21) Appendix P, Section 4.1.4.4, page 106: references Section 4.1.5.1. and 4.1.5.2; these sections are not included in Appendix P.

(22) Appendix P, Section 4.2.2.1 (page 110) and Section 4.2.2.2 (page 115): the appendix should include appropriate figures showing the results of the PCA.

(23) Appendix P, Table 4-4, page 112: the "Notes and Model Selection Rationale" sections of the table include references to EFA loading factors which are not identified in Section 4.2.2.1 (page 110). In addition, note the following -

- Abundance – states "[t]he full model is significantly better than the other models according to the F-test results". F-test results are either statistically "significant" or "not significant" at the selected alpha-probability level ($p < 0.05$) – all but the null model were apparently significant.
- The "Notes" sections frequently do not identify the most important parameters in the selected "best" model.

(24) Appendix P, Table 4-5, page 116: the "Notes and Model Selection Rationale" sections of the table include references to EFA loading factors which are not identified in Section 4.2.2.2 (page 115).

(25) BERA Figure 6-1 (page 226) shows that the "Risk to the benthic community" is the result of three (3) LOE: (1) the Sediment SQT WOE Analysis, (2) Tissue bioaccumulation LOE, and (3) Surface Water LOE. Therefore, in BERA Section 6 (inclusive), the results of the SQT evaluation reflect potential impacts to the benthic invertebrate community resulting from acute/chronic toxicity and/or habitat conditions, not the overall "risk to the benthic community".

(26) Figure 6-3: note that "High" impact LPRSA locations are clustered in five (5) areas –

- ~RM 3.7
- ~ RM 5
- RM 6.5 to RM 7
- RM 13 to RM 15
- RM 16.5 to RM 17

(23) Appendix P, Section 4.1.2.3, page 97: the MLR models were developed using the EFA loading factors (see Section 4.2.2.1, page 110 and Section 4.2.2.2, page 115) – not the concentrations of individual COPECs. These loading factors were combinations of the transformed concentrations (see Technical Comment #20) of one or more of the COPECs. In addition, it appears that some COPECs were included in more than one of the loading factors. Thus, it is extremely difficult to interpret the results of the MLR models and their potential use as a LOE in the BERA WOE SQT evaluation.

Thank you for your cooperation in this matter. If you have any questions, call Jay Nickerson at (609)633-1448, or email at Jay.Nickerson@dep.nj.gov.

Sincerely,

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